Development of Millet De-Husking Machine

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Abstract:- **Millets contain a dry external cover called husk. Removal of the husk is called De-husking. Manually De-husking is quite difficult and also requires lot of human efforts and there will be lose/damage to the crops. To overcome the difficulty, machines are developed. Existing/Conventional machines have the drawbacks such as Expensive, Bulky, Maintenance & Heavy in size, different machines are to be used for different types of crops, etc. Hence an attempt is made to overcome all the difficulties by developing a machine which is used to separate millets from its era and also De-husk all types of millets belonging to a family.**

I. INTRODUCTION

It is an agricultural machine. The millet separator andDe-husk machine peels off the millet husk from millet to obtain De-husked millet via mechanical controlled De-husking device.

This machine can provide faster work rate and less human interaction. This machine is expected to increase the millet production, hence an additional income to millet growers. It is useful to millet growers in many ways it doesn't need skilled labor, rapid, safe operation and simple maintenance. It can be easily assembled and disassembled and it can be carried from one place to another.

Millet formed important prehistoric diet in India, China, and Korean societies. Foxtail millets were important crops beginning in the early Neolithic of china. Some of earliest evidence of millet was found at cishon in north China.

The common millet husks have been identified around 8300-6700 BC in storage pits. Millets made its way from china to Black sea region of Europe by 5000 BC.

India is the world's largest producer of millets. In 1970s, all of the millet harvested in India were used as food. By 2000s the annual millets production had increase in India. In 2010, the average yield of millets crops was 0.83 tones per hectare with national wide average 3.3 tons per hectare.

Traditional techniques that were commonly used for De-husking were decorating, malting, fermentation, roasting, flaking and grinding. These methods were labour intensive and giving poor-quality product.

2. NEED OF MILLET DE-HUSKING MACHINE

2.1 Millets are store- house of nutrition

Millets are miles ahead of rice and wheat in terms of their mineral content. Each one of the millets has more fiber than rice and wheat. Some as much as fifty times that of rice. Finger millet has thirty times more calcium than rice while every other millet has at least twice the amount of calcium compared to rice. Millets are also used in pharmaceutical pills and capsules.

Crop/Nutrient	Protein(g)	Fiber(g)	Minerals(g)	Iron(mg)	Ca(mg)
Pearl millet	10.6	1.3	2.3	16.9	38
Finger millet	7.3	3.6	2.7	3.9	344
Foxtail millet	12.3	8	3.3	2.8	31
Proso millet	12.5	2.2	1.9	0.8	14
Kodo millet	8.3	9	2.6	0.5	27
Little millet	7.7	7.6	1.5	9.3	17
Barnyard millet	11.2	10.1	4.4	15.2	11
Rice	6.8	0.2	0.6	0.7	10
Wheat	11.8	1.2	1.5	5.3	41

Table.2.1. nutrient content of millets

2.2 Millets produce multiple securities

While single crops such as rice and wheat can succeed in producing food security for India, millets produce multiple securities. They include securities of food, nutrient, fodder fiber, health livelihood and ecology. Millets farm not just use soil fertility for their growth but also return this fertility to this soil. Most millet has edible stalks which are the most favored fodder for cattle. Many a times, crops such as sorghum and pearl millet are grown only for their fodder value.

2.3 Millets are climate change compliant crops

Millets remain our agricultural answer to the climate crisis that the world is facing. Climate changes are expected to confront us with three challenges.

- Increase in temperature up to 2-5 degree Celsius
- Increase water stress
- Severe malnutrition

Millets are water saving, drought tolerant crops. This quality makes them India's food farming future. Millets can be cultivated without using groundwater or surface irrigation.

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3. WATER REQUIREMENTS OF SOME MAJOR CROPS

For growing of the plants crops required some amount of water to develop. Therefore Water requirements of some major crops are shown in the below table.3.1.

Table No.3.1.Crop Water requirement (mm)

Crop	Water Requirement(mm)
Millets	350-450
Rice	1200
Maize	400
Chickpea	250
Groundnut	400

4. TYPES OF DE-HUSKING MACHINE

De-husking is the process of removing the outer layer of the millets. There are several types of De-husking machines which is as mentioned below:-

1. Rice Huller or Rice De-husking Machine
2. Corn De-husking Machine
3. Pulse De-husking Machine
4. Millet De-husking Machine

4.1Rice Huller or Rice De-husking machine

It's first introduced by German Brazilian engineer **EvaristoConrado** in **1885.**Its uses steel roller to remove the husk.

4.2Advance technology type rice huller

Other types of huller includes the disk or cone huller which uses an abrasive rotating disk to first remove the husk before passing the grain to conical rollers which polish it. Rubber rollers may be used to reduce the amount of breakage of the grains. So increasing the yield of best quality head rice, but the rubber rollers tend to require frequent replacement, which can be a significant drawback.

4.3 Corn De-husking machine

A corn de-husker is a machine that husks corn to reveal the Kernels (central part) earlier this process is done by manually which is as shown in figure.4.3. People rotate the wheel and removes corn to reveal the central part. This is a mechanical type corn De-husking machine.

4.4Millet de-husking machine

Millet de-husking machine de-husk the outer layer of millets. They use roller, blower, separator after that the polishing of millets is done.

- Millet production is not dependent on the use of synthetic fertilizers.
- Millets are pest- free crops.
- Millets are amazing in their nutrition content.
- The only crops that sustain agriculture and food security on these lands are millets.
- Millets are not just crops but a cropping system.
- Most millet fields are inherently biodiversity.
- Millets produce multiple securities –food, nutrition, fodder, fibred, health, livelihood and Ecology.
- Millets are climate change compliant crops.
- Finger, Pearl & Foxtail millet are highly efficient C4 plants.

5. PROMOTING NUTRITIOUS MILLET FOR ENHANCING INCOME AND IMPROVED NUTRITION. A CASE STUDY FROM TAMILNADU AND ORISSA

Small millets comprising six species are grown in India over 2 million ha, mostly in semi-arid, hilly and mountainous regions. India has the third largest area under small millets cultivation in the world.Tamilnadu and Orissa are the one of the leading producer of millets in India .A case study have been developed for these two states.

5.1 Objectives

The aim of this project was to enhance the contributions of three nutritious millets, namely finger millet, little millet and Italian or foxtail millet of strengthen and food security and to enhance the income generation of the rural poor, with following major objectives:-

- Enhancing the product and productivity through the use of better seeds and improved cultivation practices.
- Strengthen local capability for product.
- Introducing drudgery-free grain process technology.
- Creating awareness on the importance of millet for food and nutritional security.

5.2 Preliminary surveys on uses, constraints and opportunities:

Initial surveys in kolli hills showed that the millet has been under increasing threat from tropica. The production of millet gives great strength in Tamilnadu and Orissaregion. About 12% millets are produced in these two regions of India. These two states produce mainly finger and little millet in great strength. They have great sites for the production of millet in

large amount. It has great facility and areas to produce millet in huge quantity.

5.3Yield enhancement from improved practices

Grain and fodder yield results from all the 78 demonstrates were quite encouraging majority ofthedemonstrates (68%) used intercrops, while the rest were pure crops of each of three millets. The yield from improved practices was consistently and significantly higher than that from the traditional practices of cultivation. The increase in individual's trails ranged from 11.77% with mean increase of 39%.

5.4 INCREASE IN INCOME GENERATED FROM IMPROVED AGRONOMYI

Increase in productivity achieved over traditional practices which used local varieties by improved agronomic practices using farmer selected varieties.

A comparison among demonstrations using pure crop of millet and millet based-intercrops showed that they provide higher income about 12-23%.In actual terms, the additional income generated, on an average was INR 4.5/ha in the case of finger millet based-intercrops and 2733 in the case of pure finger millet crop.

6. DEVELOPMENT OF VALUE CHAINS OF NUTRITIOUS MILLET GRAINS

6.1 REDUCTION OF DRUDGERY IN PROCESSING NUTRITIOUS MILLET GRAINS

Nutritious millets are neglected in all respects including technology development for grain processing. There is no efficient technology for processing these grains. Such lacks of technology has been forcing the dependence on traditional method of grain processing. Which are tedious, time consuming and cause of drudgery for women.

This has discouraged the use of these millets in household consumption. Therefore, removal of this drudgery by innovating easy-to-operate mechanical grain processing technology is recognized by this.

6.2TRAINING WOMEN MEMBER OF SHGS ON MARKETING

Marketing of value added product was done either directly or by the member of the same SHGs which produced the product or by other SHGs which undertook specialized task in packaging and marketing the products.

The member of SHGs in jaypore made production and marketing themselves. This beginning of commercial production, these SHGs in kolli hills and jaypore marked the different product and specified brand. In short time, these SHGs learned the advantage of brand building and need for maintaining the product quality representing the brand.

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Table: 7.1 COST BENEFIT ANALYSIS OF PRODUCTION AND MARKETING OF VALUE ADDED MILLET PRODUCT

Cost benefit particulars	Laddu	Chakli	Malt	LM Rice	IM Rice	FM Rice
Cost of production 100kg (INR)	4108	3401	4075	1300	1300	795
Total return from 100kg (INR)	5625	4600	6000	2500	2500	900
Net return from 100kg(INR)	1517	1199	1925	1200	12000	105
Profit as % of cost	37%	35%	47%	92%	92%	13%

8. THE MAIN COMPONENTS OF MILLET SEPARATING AND DE-HUSKING MACHINE

1).Rollers
2).Mesh
3).hopper
4).Drum
5).Gears
6).Electric Motor

8. 1.ROLLERS

Fig: No.8.1. Rollers

It is an agricultural tool. It is a cylinder that rotates about central axis and is used in various machine and devices to move, flatten, or spread something. This tool is used to separate the millet from spike in the millet separating chamber.

There are three stages of roller is used in this machine. If the millet is partly removed in first stage then the third and fourth stage will completely remove the millet. In this machine rubber roller has been used, since the strength required to remove millet from is less.

8.2. MESH

The welded wire mesh is a metal screen that is made up of low carbon steel wire or stainless steel wire. It is available in various sizes and shapes. It is widely used in agricultural,

industrial, transportation, horticultural and food procuring sector.

8.3. STAGES OF WORKING:-

1. Hopper with feeder
2. Rollers with rubber padding to separate
3. Manually vibrated meshes
4. De-husking drum

In working operation, initially the millet spike is fed to the hopper. The hopper is aligned with the rollers. There are two sets of roller are used with rubber padding to separate the millet from spike. The roller is driven by suitable gear arrangement which is connected to the motor. The first set of roller will partly remove the millet from the spike. In next set of roller the millet is fully removed from the spike. In next stage, the millet will come to the manually vibrated meshes. There are three different sizes of meshes are used. The size of upper mesh will be coarser than other two. The different sizes of millets are separated in different mesh and the husk is collected on mesh which is manually removed. The mesh is not fixed to the machine, it can be easily removed from the machine and collected husk can be easily carried out.

In next stage, the millets come to the De-husking drum which is mounted on the lower part of the machine. By the suitable mechanical movement of De-husking drum the millet husk is completely removed from millet and the De-husking process is completed. The De-husked millet is finally collected from the lower part.

Fig. 8.3 Millet separating and De-husking machine

8.4 De-husking of little Millet using rubber rolls Sheller with abrasive grain:-

Formula used to calculate De-husking efficiency, head grain yield, broken percentage and milling efficiency

De-husking efficiency% = A/B *100

Head grain yield%=C/A*100

Broken %=D/A*100

Milling efficiency%=E*F/100

Where,

A- Weight of milled grain (head grain and broken) (kg)
B-Weight of grains fed to machine (kg)
C-Weight of head grains (kg) (round and clean De-husked grains)
D-Weight of broken grains (kg)
E-De-husking efficiency
F-Head millet yield

9. ADVANTAGES AND DISADVANTAGES

9.1 ADVANTAGES:-

- Millet De-husking machine reduces the human effort.
- The operation is simple compared to manual method.
- Its Implementation increases the millet production rate.
- It is a time saving process.
- Its maintenance is easy.
- Simple in construction and occupy less space.
- It can be carried from one place to another easily.

9.2 DISADVANTAGES:-

- The initial investment is high.
- The operation is noisy.
- It consumes more power.
- Complete De-husking of millet is not possible.
- Wear and tear of machine.

10. CONCLUSION

Since there is abundance of millet which is not being used, by the principle of millet De-husking the millet being wasted can be utilized which can be used as food .Millets like rice, wheat which get deplete in coming decades because of global warming. So there is huge demand for Millet De-husking machine.

This machine can provide faster work rate and less human interaction. This machine is expected to increase the millet production, hence an additional income to millet growers. It is useful to millet growers in many ways it doesn't need skilled labor, rapid, safe operation and simple maintenance. It can be easily assembled and disassembled and it can be carried from one place to another.

11. SCOPE FOR FUTURE IMPROVEMENTS

- This is a prototype, if it is built in large scale, large amount of millet can be separated and De-husked, which is a challenge in current world need.
- If good quality materials are used, better performance may be achieved.
- Design and material selection are very important aspects to increase the efficiency.
- If rollers and mesh are connected together, fabrication cost and material cost can be reduced.
- If separation part is constructed properly, then large quantity of millet can be separated.

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